# CEMS – Master in International Management

# Launching Wind for Prosperity Initiative in Asia Pacific

*Final Working Project*

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## I – The Company, the Market and its current situation

Vestas Wind Systems A/S is the largest wind turbine manufacturer in the world. It has installed over 60GW of wind power capacity through more than 51,000 turbines in 73 countries throughout its 30 years of experience[i]. The Danish group initially manufactured household appliances and produced its first wind turbine in 1971: a 10-meter rotor and 30KW machine. Nowadays, its latest turbine is the V164, 164m rotor and a 8MW generator.

Vestas merged with Danish wind turbine manufacturer NEG Micon in 2003 to create the world leader in wind turbines manufacturing: Vestas Wind Systems A/S. In 2006 it controlled 28% of the market share and, despite still being the market leader and having significantly increased its output, it saw its market share fall to 13.1% in 2013[ii] amidst increasing external competition. Its main competitors are China's Xinjiang Goldwind, Germany's Enercon and Siemens and the US's GE, whose market shares are shown in appendix 1.

In the past 15 years Vestas has only lost its leading position in 2012, in the aftermath of a terrible financial and operational year, dictated by the overwhelming external competition and internal challenges. Acknowledging these challenges, it underwent a 2-year restructuring plan which entailed refocusing its operating business model towards its core area of turbine manufacturing, divesting in non-core businesses and improving capital efficiency and capacity utilisation. This included reducing its factories from 31 to 19 in just two years (appendix 2). Its current CEO, Anders Runevad, was brought in amidst these changes in 2013. Most importantly, it has been optimizing its operations through cost reductions, which included a trimming of its workforce from 22,700 in 2011 to below 16,000 in 2013 and reducing CAPEX from €761M to €239M in the same period[iii].

Vestas' 2013 performance marks its turnaround: its market cap soared, its ROIC was 7.7% (compared to 0.2% the previous year) and customer orders of over 6GW – compared to 3.8GW in 2012. Financials for Vestas are shown in appendix 3. As it stands, its current ultimate goal is "achieving cost leadership within the wind power industry"[iv], which can be observed in appendix 4 with the reduction of its average selling price in 2013.

Going forward, as the energy market increasingly shifts towards Asia, some of the industry's main strutctural questions are the gaps in supply and demand for energy, the level of government support (GE's fall in market share in 2013 was almost exclusively due to lower wind subsidies in the US[v]), improvements in technology and the cost of other sources of energy (also dependent on subsidies given[vi]).

For the medium-term, foreseeable changes include the emergence of offshore wind capacity[vii], the replacement of old power plants in Europe and the US[viii] and the widening gap in electricity generation between OECD and non-OECD countries, as is portrayed in appendices 5 and 6. The wind market is forecasted to grow between 4 to 10% CAGR, according to different estimates[ix]. The IEA projects 4,500GW of extra capacity is required worldwide by 2030 to meet demand, through the rebuilding of old plants in developed economies and heavy investments in new grid and capacity infrastructure in emerging markets[x].

Vestas' goals are set to keep pace with these changes: "Bringing wind on par with oil and gas". It wants to reduce the levelised cost of energy, improve its operational efficiency and achieve stable growth in both emerging and developed markets, leveraging on its large scale operations, its strong brand and exclusive focus on wind energy.

## The Business Project and Summary of Conclusions

The Business Project (BP) proposed by Vestas was "Launching Wind for Prosperity Initiative in Asia Pacific". The BP's goal was for the team to identify major target markets in the Asia Pacific region for Vestas' CSR program Wind for Prosperity (WfP). The initiative consists on deploying refurbished KW-class turbines[xi] in a wind-diesel solution to remote (off-grid) communities in this region, while still generating attractive returns for local investors. These wind sites will then be operated by local Independent Power Producers (IPPs).

The challenge for the group was to identify suitable markets and investors for launching this project in the Asia Pacific region. This was divided into three stages, as shown in appendix 7: (1) identify countries with best wind potential from initial list of 29 countries (2) select optimal wind-sites for shortlisted countries and (3) identify 3-4 potential investors per selected country, indicating the rationale for investing in WfP. In all stages it was up to the team to identify the most suitable approach, with a preliminary meeting with Vestas to guide our efforts and clarify our doubts regarding the technicalities of each phase.

The deliverables of the BP were of a qualitative nature – recommendations made on behalf of the Team to Vestas based on our own selection criteria and analysis of market context and conditions. Our recommendation consisted on a final shortlist of five target countries for WfP: India, Pakistan, Myanmar, Philippines and Vietnam. In each of these countries the Team identified 4 tier 1 potential investors and several tier 2 investors for Vestas' consideration, based on company size, sector, history of CSR programs, location of operations and other several criteria. A summary table can be found in appendix 8. This final stage was the most complex as it entailed broad knowledge of a whole country to establish the best potential investors. Given the time constraints, the team focused on an approach based on financial markets to identify and then filter the top candidates. The focus of this WP will look onto other approaches to further complement the process in identifying in-country opportunities.

## II – Development of a specific topic: Profitability and Feed-in-Tariff analysis of WfP

Originally, the plan for the BP entailed four stages, the last of which was later eliminated due to time constrains. This final stage consisted on analysing the wind feed-in-tariffs (FIT) and current renewable energy (RE) policy landscape to determine the financial feasibility of WfP in each of the selected countries. Considering this shortcoming of our BP, this WP looks to complement the work already done to deepen the understanding of the policy environment for feed-in-tariff implementation (with in-depth analysis for the Philippines) and add an altogether new analysis about the sensitivity of WfP's returns to FIT and capacity.

The analysis will be divided into three sections. Firstly an overview of the energy conditions in Southeast Asia and recent developments in terms of policies. Secondly, a detailed outlook for the Philippines will be provided including (a) the main players and issues of their energy sector and (b) the recent changes in terms of RE policy. Lastly, a financial analysis will be provided for the Wind for Prosperity business case in the Philippines.

My goal in this main section of the WP is to complement, enhance and even add upon what was developed during the BP. Ultimately, this WP's analysis should add value towards the implementation of Wind for Prosperity. To achieve this, I coordinated the analyses directly with Vestas' representative to know what questions still needed answering.

### Southeast Asia's energy landscape

Energy demand and generation in Southeast Asia (along with China and India) have evolved greatly since the 1990s, to the point where they are becoming the highest potential energy market in the world. Huge differences are present between the ten ASEAN members yet, overall, they are countries with low electrification rates, distorted electricity/energy price markets and with a high share of renewable in the primary power generation mix (24%, almost double of the world average)[xii]. Energy demand in ASEAN is projected to grow at more than double the speed of global demand until 2035, meaning an additional 300GW of capacity will need to be added to the 176GW of already installed capacity as of 2011[xiii].

Renewable energy's installed capacity accounts for approximately 43GW in 2012 and is expected to increase to 130GW in 2035. The most developed renewable sources of energy are hydropower (given abundant resources available, namely near the Greater Mekong Sub region) and biomass (since the low electrification rates and poor grid access dictate that several people resort to biomass for cooking and other basic needs).

The Philippines market is an outlier amidst the typical ASEAN energy markets, since it underwent a major restructuring and privatization which began in the late 1990s. Despite still resorting to some fossil-fuel subsidization to protect its population from strong price hikes, it does not provide any electricity price subsidies and spends a much lower percentage of GDP than countries in the region (appendix 9). It has therefore created favourable conditions for the competitiveness of renewable energies and innovative fuel efficiency technology. There have been several efforts on behalf of other ASEAN members to implement subsidy reforms yet have proven insufficient. As of 2012, fossil-fuel subsidies amounted to $51b with 68% going to oil and 24% going to electricity as is shown in appendix 10.

On a separate note, it is interesting and worth observing the correlation between the Energy Self-Sufficiency Index and the expenditure on fossil-fuel subsidies shown in appendix 11. Although there are notable exceptions, namely due to different sizes of GDP – China and India's undershoot the magnitude of their fossil-fuels while Turkmenistan and Uzbekistan's small economies overshoot it –, we can observe that countries with a higher degree of fuel-dependency will spend less in fossil-fuel subsidies as a share of GDP. This may be explained by the monetary constraints of a fuel-importing economy and by the fact that by subsidizing these fuels more, they would be deteriorating even further the sustainability of their energy conditions in the future. This perspective could be seen as an alternative to identify candidates for Wind for Prosperity and other green energy initiatives.

Another important aspect to characterise the energy landscape in Southeast Asia is the energy and RE policies in this region. There are significant differences among the countries but, according to IEA's WEO 2013, you find common goals relating with increasing power generation capacity and increasing the share of RE in the primary generation mix. A summarizing table can be found in appendix 12. In the countries with sub-par grid electrification, the respective energy authorities are also promoting ambitious electrification programs. Examples of this are Cambodia (70% household grid electrification by 2030), Indonesia (99% household electricity access by 2020), Laos (household electrification to 80% by 2015) and the Philippines (90% household electrification rate by 2017).

The analysis means to provide a broad perspective on the energy landscape in Southeast Asia before analysing the Philippines specifically. Most importantly, it adds an extra dimension and perspective to what was done during the first two stages of the BP. These stages were done mostly following Vestas' instructions and didn't directly contemplate the future environment of energy in SEA, focusing instead on the country-ranking indicators (stage 1) and on the wind conditions to select the sites (stage 2); in that sense, it provides a contextualizing bridge between stage 2 and 3, before entering the investor selection exclusively. The following section looks to shed light on the demand-gap in the Filipino energy sector regarding RE facilities and the fiscal and operational (Feed-in-tariffs) in place.

## Energy Sector in the Philippines

The Filipino energy sector has undergone significant changes in the last 20 years. Since the late 1990s a series of deregulatory measures and privatization process began. The enactment of the Electric Power Reform Act of 2001 (EPIRA), formulated by the Department of Energy (DOE) was the culmination of this process, setting the ground for the reform and restructuring of the whole sector. The DOE, alongside the National Power Corporation (NPC) who until then was responsible for power generation, transmission and distribution services across the Philippines, created the Power Sector Assets and Liabilities Management Corporation (PSALM) to be the vehicle of reform and gradual privatization of the state-owned facilities. As of December 2012, PSALM has privatized more than 70% of the total generation capacity held initially held by NPC, totalling 4.6GW. Before EPIRA and since the early 1990s, the Philippines already showed a successful history of privatizing power generation through Independent Power Producers (IPPs), which is especially propitious for Wind for Prosperity given its IPP-based business model.

As it stands, the Philippines presents Today power generation is done by several players, the biggest of which is still state-owned NPC and PSALM (24% market share), followed by San Miguel Energy Corp (20%), Aboitiz Power Corp (17%) and First Gen/First Gas (17%). Mindanao (one of the three regions of the Philippines) is the least privatized energy market, with NPC and PSALM controlling 79% of the market, counting only with Aboitiz Power as the main private player (18%). The two other regions, Luzon and Visayas, are now fairly competitive markets with atleast five different private players supplying power. Appendix JJ portrays the main players in each region.

All these players are potential targets for Wind for Prosperity, many of which were identified in the BP. What the BP does not include are the players of the Transmission and Distribution networks which, considering the electrification targets proposed by the DOE and the scope of WfP, may also be potential targets not just for CSR purposes but also to achieve important milestones. Transmission is currently done by the National Grid Corporation of the Philippines (privately-owned), who owns a 25-year concession which began in 2008. Its main goal is to fight off the recurrent power outages (most frequent in Mindanao) and improve inter-island grid connectivity across the country.

Power distribution is done by regional electric cooperatives, most of which are privately owned by power generating companies. The largest one is MERALCO, which serves the Metro Manila area, and the second largest is VECO, which serves the Cebu metro area, the country’s second largest city.

As of May 2013, installed capacity in the Philippines is 17,025 MW, with wind energy accounting for a mere 33MW[xiv]. The high electricity prices established by the market through the WESM[xv], driven mostly due to high generation prices (due to expensive fuel imports) and the inexistence of electricity subsidies are behind the Philippines' push to adopting alternative energy sources and their ambitious RE targets to be discussed below. As of 31st January 2014, the DOE had awarded a total of 1849.5MW in potential capacity to wind projects in Luzon and Visayas[xvi], including an 87MW site in North Luzon to be supplied by Vestas and begin operations by 2015.

The Philippine Energy Plan 2012-2030 (launched Dec. 2013) is the most important energy policy currently in place with the main goals of fighting power shortages and respond to rising demand in the future. Its main goal is to increase the country's installed capacity from 17.025GW as of May 2013[xvii] to approximately 26GW by 2030. Even so, demand is projected to exceed 29GW. Another key policy for WfP is the Renewable Energy Act of 2008, which established two essential targets: achieve 90% rural electrification rate by 2017 (it stands at 80.18% as of September 2013[xviii]) and increase the renewable generation capacity to 15.3GW by 2030. While the RE target will be mostly met through geothermal and hydropower capacity – the country's largest renewable resources – wind power also has a specific target of 2.345GW of installed capacity and of achieving grid parity – levelized cost of production being the same as buying power directly from the electricity grid – by the same year.

Another measure of the RE Act of 2008 was the implementation of feed-in-tariffs (FITs) for renewable energy sources. In July 2012 the Energy Regulatory Commission (ERC) approved FIT for hydro, biomass, wind and solar energy (appendix 13). The wind tariff was set at 8.53 PHP/kWh (0.138 EUR/kWh) fixed for the first 20 years of the project and applicable until the goal of 200MW of capacity has been fulfilled.

Amidst such a deregulated and competitive energy sector as the Filipino one, the implementation of the FIT for renewable energies is done with caution to minimize distortions and loss of competitiveness. In fact, the tariffs approved by the ERC for solar and wind were significantly lower than the ones originally proposed by the National Renewable Energy Board, to reflect the downward trend in construction costs for these types of plants. Furthermore, the ERC will periodically (every 3 years) readjust the tariffs according to current costs. Even so, compared to countries with similar FIT schemes, the Philippines present the second most attractive tariffs after Sri Lanka, as is shown in appendix 14.

Lastly, the RE Act of 2008 promotes a series of fiscal and non-fiscal incentives which can further enhance the attractiveness of a RE project for a potential investor. Certified developers of renewable energy facilities will have income tax holiday for seven years, duty-free importation of RE machinery, equipment and materials, a corporate tax rate of 10% on its net taxable income after 7 years, 0% VAT rate on sale of power generated among other incentives. Manufacturers and suppliers of the RE equipment also benefit from tax and duty free importation of components and materials needed for the manufacturing.

## Feed in Tariff analysis for Wind for Prosperity

Having understood the conditions of the Filipino energy market, the policies in place and the incentives to undertake a project such as Wind for Prosperity, we now look at the financials of the project. The question to be answered is if a project such as Wind for Prosperity is feasible under the conditions available regarding FIT, and how it affects the project's profitability.

The analysis that follows was done under guidance from Vestas and based on two documents: (A) a sample financial model including FIT provided by the DOE of the Philippines and (B) a benchmark project economics sheet with the technical, operational and financial requirements for the two types of turbines being used in WfP (V27-225kW and V47-660kW). The process consisted on adapting the model in document A with the information contained in document B, to obtain the financial projections for Wind for Prosperity plants in the Philippines.

Among the several inputs required for the model to work, the two main inputs which are the anchor for the analysis are two: installed capacity of the facility (stemming from the number of turbines per site) and the FIT. The base case is a facility with two turbines and a fixed-rate FIT of 8.53 PHP/kWh. Consequently, the capacity of a V27 facility is 0.45MW and a V47 one will have 1.32MW. Other relevant inputs for each turbine are summarized in appendix 15. Under the base case, the V27 facility generates an IRR of 20% and the V47 one reaches 45.2%.

For the sensitivity analysis, I considered a range of 1 to 10 V27-225kW turbines, resulting in a capacity of 0.225 to 2.25MW. Regarding the V47-660kW facilities, a WfP facility would have 1 to 5 units resulting in a gross capacity of 0.66 to 3.3MW. This capacity constraint reflects the fact that a WfP facility will have a maximum capacity of approximately 2MW, according to Vestas. The range for the feed-in-tariff was from 5 to 10 PHP/kWh. The range is skewed negatively around the base of 8.53 PHP/kWh since the FIT of the Philippines is, as has been said previously, higher than normal in the region therefore there is limited room to lobby for a further increase. Regarding the output of the analysis, the IRR of the project, the target by Vestas is 18% to be on par with the wind projects it conducted in the region. A range between 13 to 18% would also still be acceptable in the scope of WfP, as it aims to not only be a sustainable and profitable business but to bring power to off-grid regions.

The sensitivity analysis of the IRR with respect to capacity and FIT is found in appendix 16 for the V27 and appendix 17 for the V47. Overall, it is clear that a higher installed capacity generates higher returns, keeping FIT constant. Likewise, returns increase when the FIT increases, ceteris paribus. It is interesting to note the economies of scale present due to this "capacity effect": the slope of returns as a function of the FIT increases with capacity. In other words, a facility with five V27 units will see its returns increase faster as a result of an increase in the FIT than a facility with just two units. This is present at both types of facilities (V27 and V47), as is shown represented in appendix 18.

Going back to appendix 16, it can be observed that a facility with two or more V27 turbines, at the current FIT level of 8.53 PHP/kW, achieves at least the hurdle of 18% IRR. If facility only has one V27 turbine, it would only generate returns above 15% with a FIT of 8.75 PHP/kW and 18% with a FIT of 9.75 PHP/kW. Furthermore, at a capacity of 1.125MW and above (meaning 5 or more units), an IRR of 18% is attainable with a FIT of only 7 or even 6.75 PHP/kW, if 8 or more units are installed in the facility.

In appendix 17 projections show a V47 plant will always surpass the hurdle rate of 18% with the exception of a one-turbine plant with a FIT under 5.25 PHP/kWh. At the current FIT level of 8.53 PHP/kW, a Wind for Prosperity site with V47 turbines can achieve an IRR of 37%-51%, depending on capacity, making an excellent business case for WfP in the Philippines.

Lastly, comparing the returns of both types of turbines, the increased returns due to the V47's higher efficiency is clear. At a FIT of 8.5 PHP/kWh and approximate capacity of 2MW we can compare: 9-unit V27 plant generating an IRR of 26.5% and a 3-unit V47 plant generating 48.2%. However, the implementation of a V47 turbine may not always be the optimal solution, due to land restrictions and overcapacity compared to local demand.

In sum, this analysis concludes that there is in fact a business and financial case for Wind for Prosperity in the Philippines. Given the feed-in-tariffs currently in place, the project not only comes to aid in the government's target of eradicating rural electrification, but it is also poised to generate returns which are competitive with the Mega-Watt wind farms emerging around the country, by given a return consistently above 18% for most scenarios.

These two arguments – the policy landscape (e.g. fiscal incentives and official targets) and the projected returns with existing FIT – should be included in any investment pitch for Wind for Prosperity with potential investors. They complement the arguments of operational and CSR compatibility with the investors' own businesses, already contemplated within stage 3 of the Business Project. All things considered, I feel the argument is now more robust than ever for a successful venture of Wind for Prosperity in the Philippines.

## III – Reflection on learning

The qualitative nature of the BP made it a lot more focused on the actual process of achieving the deliverables than the effective final result. The coherence and thoroughness of the process (the "how") would *a priori* guarantee a reasonable output (the "what"). Consequently, the applied knowledge from my Masters was more closely related with complementary skills, not direct hard knowledge obtained. In fact, all three phases of the BP were more about the ability to scrutinize, select and analyse publicly available data in order to make the most well-informed decision possible. The ultimate goal was not an answer to a simple equation; it was a recommendation taking into account a multiplicity of variables with different weights.

Nonetheless, in the first phase of the BP my bachelor in Economics was helpful in guiding me through the ranking of the initial 29 countries – which indicators to consider, where to collect the data, reliability of given sources and more. Furthermore, the practice and experience from my masters to most effectively communicate a dense amount of information into adequate graphics and into a synthesized message within appealing body of presentation. These habits aligned with the practice of delivering executive summaries, was central in building a strong slide deck for Phase 2 and 3, which agglomerated frightening amounts of information.

By contrast, given the topic of the BP being so different from the usual workload during the Masters, I obtained new insights within the renewable energy sector (namely wind), the electricity sector and the policy frameworks in operation across many Asian countries. Phase 3 of the project was especially interesting since it allowed us to put ourselves in the shoes of a potential investor and search for what drivers and rationale would lead them to fund a wind project. By contrast, this BP allowed for a more detailed analysis of the case of the Philippines and for a bigger insight – albeit confidential – into the capital requirements and financial hurdles this time from the perspective of the wind manufacturer itself.

Regarding new methodologies and tools used, I would highlight the use of the PESTLE framework – unfamiliar to me until now – and the practice of keeping a Minutes of Meeting (MoM) to track the progress of the project. I hadn't yet realised the importance of keeping formal tracking systems regarding outputs and inputs of each involved party in the whole process of decision-making and meetings – a weakness I greatly improved upon during the BP. The MoM aided us in clarifying responsibilities and goals for each party, especially given the high amount of information flow between the team and Vestas following our meetings.

The background diversity within the group (both origins and studies) created a challenging group dynamic to accommodate the different views and practices among ourselves. Given the different backgrounds, we all had different approaches to the depth of analysis required. I, as a more detail-oriented, would end up agglomerating a lot of information outside the scope of the project and, by contrast, the member with an engineering background was very direct and simplistic in delivering his research and conclusions. We fed off each other to strive for the optimal middle ground, to guarantee a homogeneous and balanced final output.

A positive aspect I was able to imprint on the team was my ability to build the presentation into a more convincing persuasive body. I was able to channel my experience acquired through the numerous case-study presentations, my internship and my teaching assistant role into a better outcome for the “how” side of the project. By contrast, I deeply learned from one of our members with 7 years of working experience who was more comfortable in asking things directly in the meetings with the company, allowing us to quickly clarify doubts.

With the benefit of hindsight, I would deem the PESTLE analysis done in stage 2 as the least value-adding component. It seemed unimportant and not specifically relevant for the final output of the project, especially since we would be providing Vestas with something they already knew. We overcame this by communicating with them and understanding that they actually wanted a different perspective on all stages of the project. By contrast, Vestas’ availability and engagement with the project was the most value-adding aspect of our BP, clearly defining the scope and expectations of the project from the first meeting. Furthermore, it is rewarding to see that our output – both the BP and the Return Sensitivity analysis – will serve as a benchmark for future market analyses/prospection done within Vestas for WfP.

Despite my satisfaction with the outcome of the project as a whole, there is always room for improvement. The investor selection process could be improved, namely in diminishing its exposure to the unpredictability of the available data for local companies in under developed countries. This hampers and biases the results towards firms for which we find the necessary information (e.g.CSR programs, sustainability reports, location of operations) – possibly resulting in the exclusion of worthy candidates for which no public information was found. In this sense, it would have been interesting to have an intermediary meeting with Vestas halfway through phase 3 to discuss their own insider knowledge regarding local companies, to provide us more on-field orientation. Despite this, the final list of selected firms were very much in line with what the company had in mind from their businesses in these countries.

In sum, it comes to show that no complete market analysis can be done by simply sitting behind a computer and analysing data; a hands-on approach is still required to get a broad understanding of the potential investors’ availability and interest. It is naturally beyond the scope (and budget) of a short-term project such as the one at hand. Nevertheless, one should always bear in mind that the story on paper may be very different to the one in practice!

# Appendices:

**Appendix 1** – Market Share of players top in the wind industry (2010-2013)

| | 2013* | | 2012* | | 2011° | | 2010° | |
|---|---|---|---|---|---|---|---|---|
| **Vestas** | **1** | 13.1% | **2** | 14.0% | **1** | 12.7% | **1** | 14.8% |
| **Xinjiang Goldwind** | **2** | 11.0% | **7** | 6.0% | **3** | 8.7% | **4** | 9.5% |
| **Enercon** | **3** | 9.8% | **5** | 8.2% | **5** | 7.8% | **5** | 7.2% |
| **Siemens** | **4** | 7.4% | **3** | 9.5% | **9** | 6.3% | **9** | 5.9% |
| **GE** | **5** | 6.6% | **1** | 15.5% | **6** | 7.7% | **3** | 9.6% |

* Source: BTM Consulting

° Sources: Cleantech Investor, IHS Emerging Energy; BTM Consult; MAKE

**Appendix 2** – Production sites of Vestas Wind Systems A/S as of Dec 2013


Source: Vestas Investor Presentation

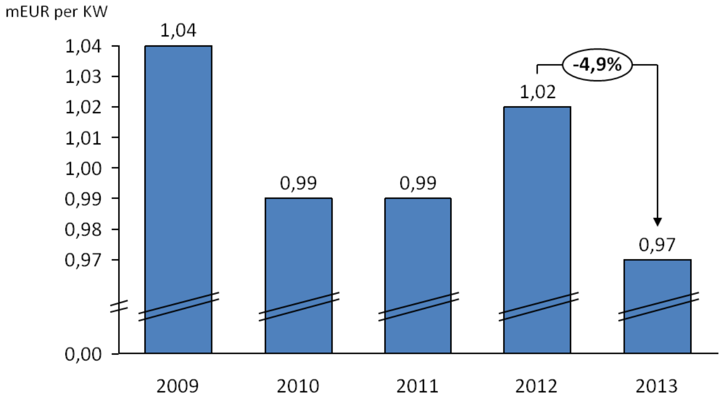
**Appendix 3** – Financial data for Vestas (2009-2013)

| Values in M EUR | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|
| Market Cap | 8646 | 4794 | 1687 | 864 | 4333* |
| Revenue | 5079 | 6920 | 5836 | 7216 | 6084 |
| Net Income | 125 | 156 | -166 | -963 | -82 |
| Employees (#) | 20730 | 23252 | 22721 | 17778 | 15497 |
| Order intake (MW) | 3072 | 8673 | 7397 | 3738 | 5964 |

* On 24 April 2014, Vestas' market cap was €7019.5M

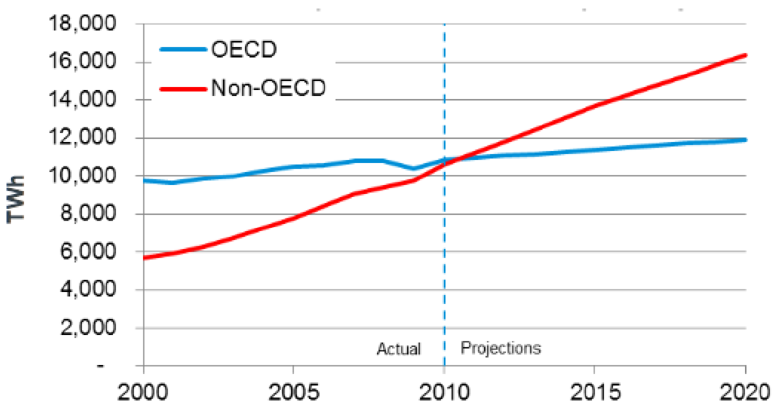
Source: Bloomberg; Vestas Investor Presentation

**Appendix 4** – Average selling price of an order intake at Vestas



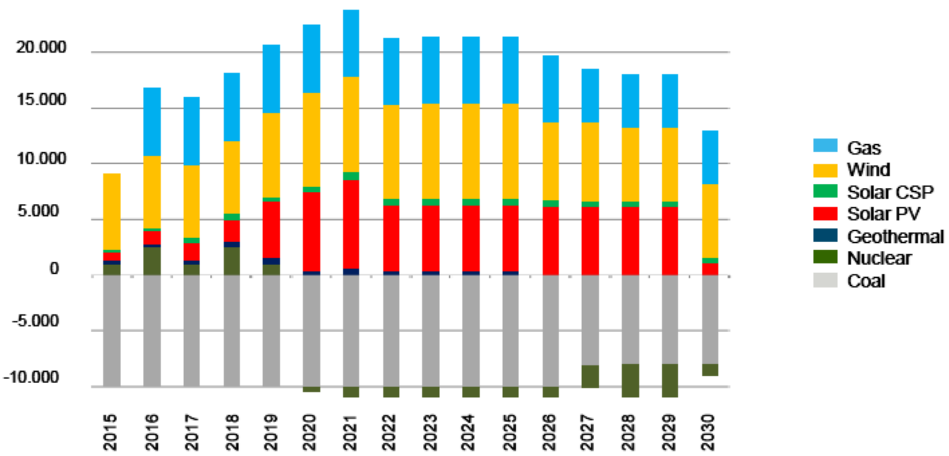

Source: Vestas, Investors presentation

**Appendix 5** – Energy generation in OECD and non-OECD countries (2000-2020)



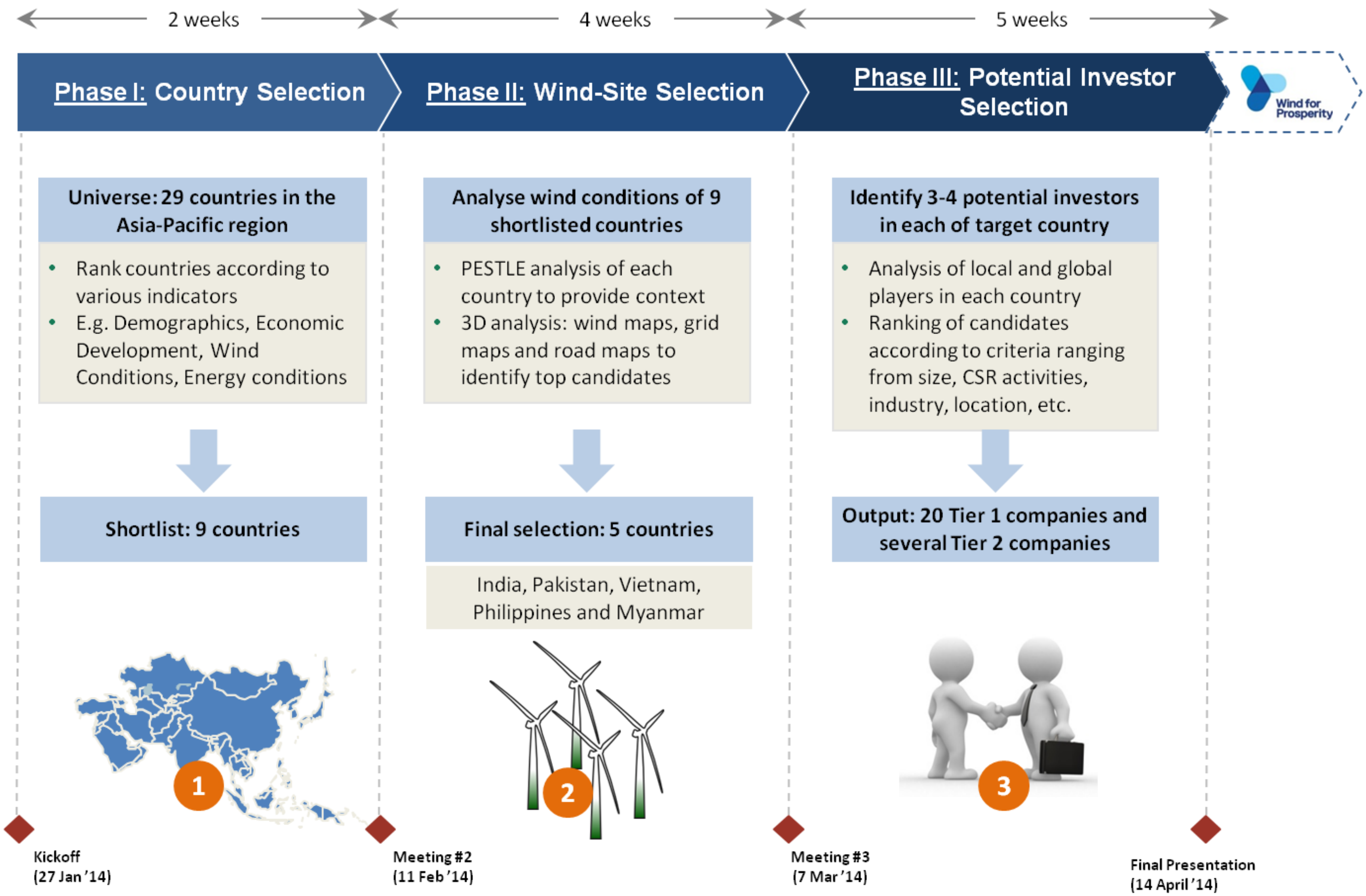

Source: World Bank WDI (May 2013) for actuals; OECD WEO 2012 for projections; Vestas

**Appendix 6** – US energy forecasts of new capacity additions/removals (MW, 2015-2030)




Source: DB Climate Change Advisors; Vestas

**Appendix 7** – Overview of the process of the Business Project



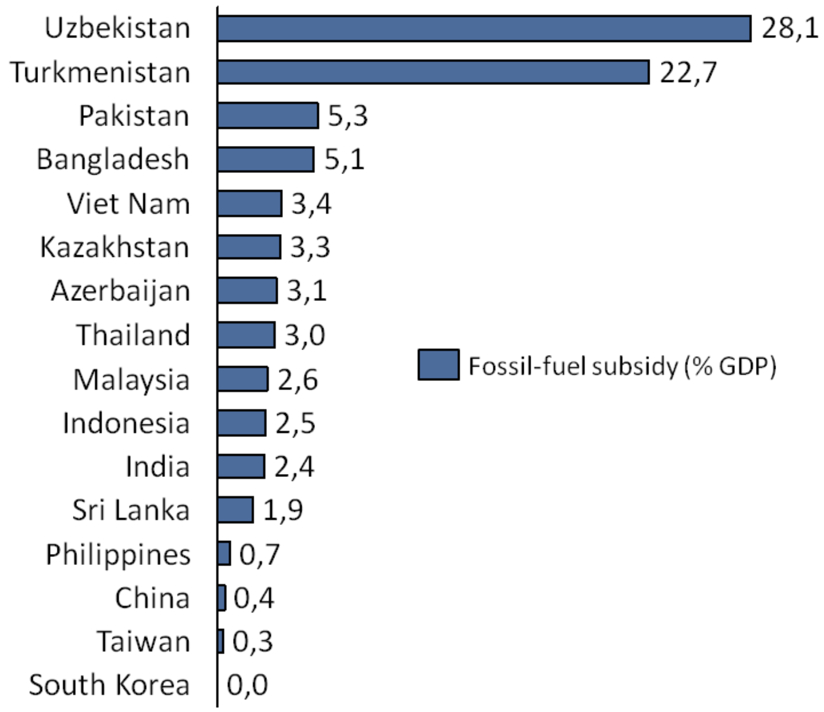
**Appendix 8** – Summary table of potential investors identified for WfP in target countries

| | **Tier 1** | | **Tier 2** | |
|---|---|---|---|---|
| **India** | Bharti Airtel | Essar Oil | Hira Godawari | Indian Oil |
| | Wipro | Mahindra & Mahindra | Tata Docomo | BSNL |
| **Pakistan** | Pakistan Petroleum | Fauji Fertilizer | ENI S.p.a. | Lotte Chemical Pakistan |
| | Engro Corp | Mari Petroleum | Millat Group of Companies | PTCL |
| **Myanmar** | Total SA | Telenor Group | Nissan | |
| | Proximity Designs | Caterpillar | Du Pont | |
| **Philippines** | Aboitiz Power | First Gen & EDC* | Ayala Land | Semirara Mining |
| | Petron Corp | Global Business Power Corp | Globe Telecom<br>SM Prime Holdings | PLDT |
| **Vietnam** | Vinamilk | Minh Phu Seafood Corp | VTI JSC | Camimex |
| | FPT Corp | Holcim Vietnam | Members of VBSCD** | |

* Energy Development Corporation

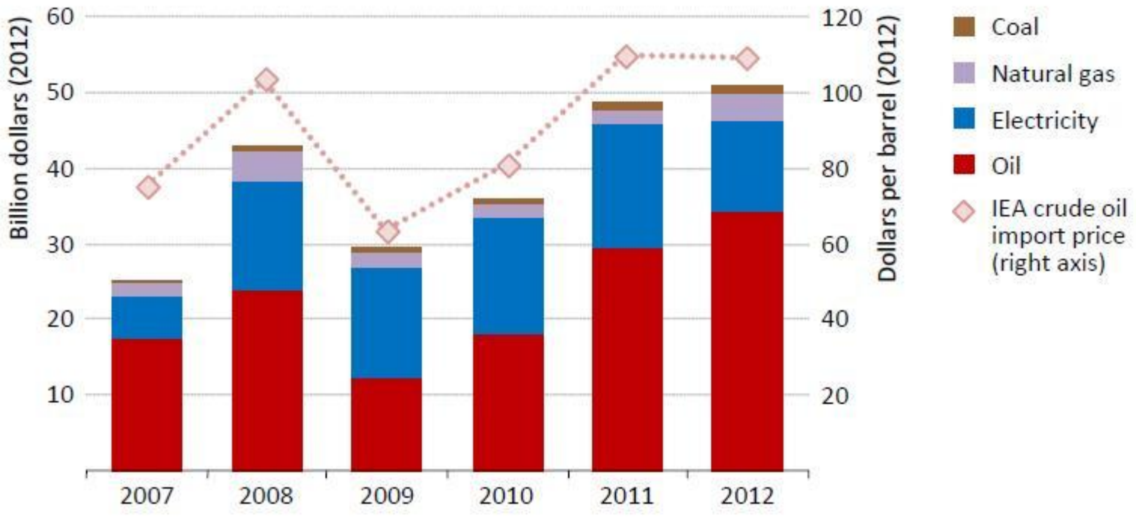
** Vietnamese Business Council for Sustainable Development

**Appendix 9** – Fossil-fuel subsidy in Asian countries as percentage of GDP, 2011



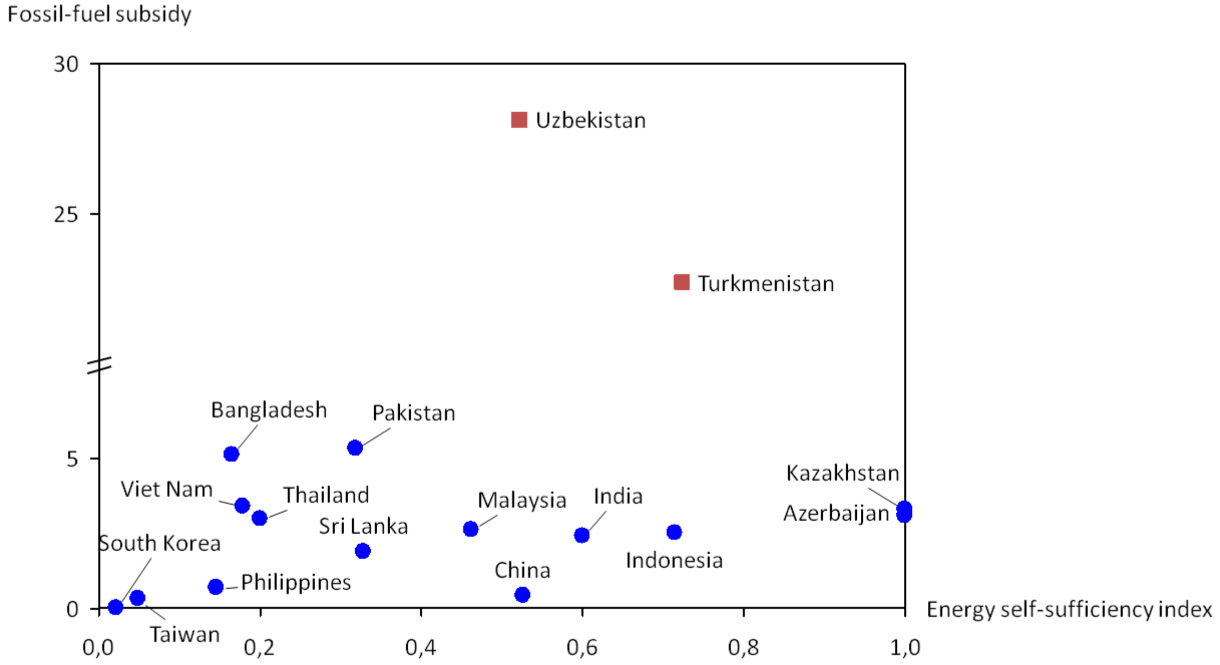

Source: Asian Development Outlook 2013: Asia's Energy Challenge

**Appendix 10** – Economic value of fossil-fuel subsidies by fuel in ASEAN




Source: IEA WEO 2013 Special Report: Southeast Asia Energy Outlook

**Appendix 11** – Fossil-fuel subsidy (% GDP, 2011) and Energy self-sufficiency index (forecast, 2035)




Source: Asian Development Outlook 2013: Asia's Energy Challenge

**Appendix 12** – Fossil-fuel subsidy (% GDP, 2011) and Energy self-sufficiency index (forecast, 2035)

| | Energy policies |
|---|---|
| **Brunei** | Reach 10MW of solar PV capacity by 2030 |
| | Reduce energy intensity by 25% by 2030 compared with 2005 |
| **Cambodia** | 15% share of renewables in generation by 2015 |
| | Reduce energy demand intensity by 10% by 2030 |
| | Household grid electricity access of 70% by 70% |
| | 100% electricity access in any form for villages by 2020 |
| **Indonesia** | Reduce share of oil (to <25%) and natural gas (to 22%) in energy mix by 2025 |
| | Increase share of RE (>23%) and coal (>30%) in energy mix by 2025 |
| | 99% household electrification rate by 2020 |
| | Fast Track Program 1 and 2: programs to increase power generation; 5 year behind schedule |
| **Laos** | Build 5GW in hydropower and 1.9GW in coal-fired capacity by 2015 |
| | 30% share of renewables in primary energy by 2025 |
| | Household electrification rate to 80% by 2015 and 90% by 2020 |
| **Malaysia** | Add 3.1GW of new capacity and replace 7.7GW by 2020 |
| | 985MW installed RE capacity by 2015 |
| | 13% of renewables in generation by 2030 |
| **Myanmar** | Share of renewables in generation to 15-18% by 2020 |
| | Reduction in primary energy consumption by 5% in 2020 and 8% by 2030 |
| **Philippines** | Increase generation capacity to 29GW in 2030 (16GW in 2011) |
| | Reach 15GW of installed renewable capacity by 2030 (mostly geothermal and hydropower) |
| | 90% household electrification rate by 2017 |
| | 100% sitio ("small-township") electrification by 2015 |
| **Singapore** | 5% peak electricity demand supplied by RE sources by 2020 |
| | Reduce energy intensity by 20% by 2020 and 35% by 2030 compared with 2005 levels |
| **Thailand** | Increase generation capacity to 71GW in 2030 |
| | Increase share of RE in final consumption to 25% by 2021 |
| | Reduce energy intensity by 25% by 2030 compared with 2005 levels |
| **Vietnam** | Increase generation capacity to 75GW by 2020 and 150GW by 2030 |
| | 5% of renewables generation by 2020 |
| | 100% rural household electrification by 2020 |

Source: IEA WEO 2013 Special Report: Southeast Asia

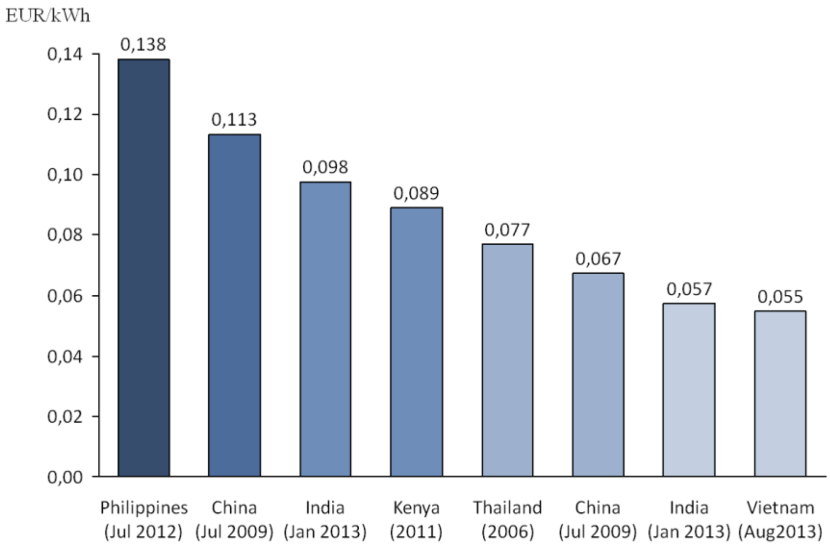
**Appendix 13** – Feed-in-tariffs in the Philippines

| | Proposed (NREB, Jul 2011) | | **Approved (ERC, Jul 2012)** | |
|---|---|---|---|---|
| | PHP/kWh | EUR/kWh* | PHP/kWh | EUR/kWh* |
| Hydro | 6.15 | 0.100 | 5.9 | 0.096 |
| Biomass | 7 | 0.114 | 6.63 | 0.108 |
| Wind | 10.37 | 0.168 | 8.53 | 0.138 |
| Solar | 17.95 | 0.291 | 9.68 | 0.157 |

*Exchange rate PHP/EUR of 0.0162 (as of 24 April 2014)

Source: Energy Regulatory Commission of the Philippines

**Appendix 14** – Feed-in-tariffs across Wind for Prosperity target markets (EUR/kWh)




Note: exchange rates applied at values of 24 April 2014
Source: Various energy agencies, Wind-works.org

**Appendix 15** – Technical and Financial inputs used for the financial model of V27 and V47

## Turbine V27-225kW

- Unit Capacity of Plant (MW): 0.225
- No. of units: 1 to 10 (0.225 to 2.25MW gross installed capacity)
- Plant availability factor: 35%
- Guaranteed Efficiency Factor: 92%
- Allowance for losses and own use: 5%
- Equipment, Transportation and Bal. of Plant Costs ($000/MW): 1800
- Switchyard and Transformers ($000): 48
- Dev't & others ($000): 150
- O&M costs ($000/unit/yr): 0.2*
- Refurbishment costs (% of EPC): 0.5%

## Turbine V47-660kW

- Unit Capacity of Plant (MW): 0.225
- No. of units: 1 to 10 (0.225 to 2.25MW gross installed capacity)
- Plant availability factor: 35%
- Guaranteed Efficiency Factor: 92%
- Allowance for losses and own use: 5%
- Equipment, Transportation and Bal. of Plant Costs ($000/MW): 1800
- Switchyard and Transformers ($000): 48
- Dev't & others ($000): 150
- O&M costs ($000/unit/yr): 0.2*
- Refurbishment costs (% of EPC): 0.5%

Financials assume cost of debt of 8%, debt-to-equity ratio of 70/30 and income tax of 0% (years 0-7) and 10% (year 7+)

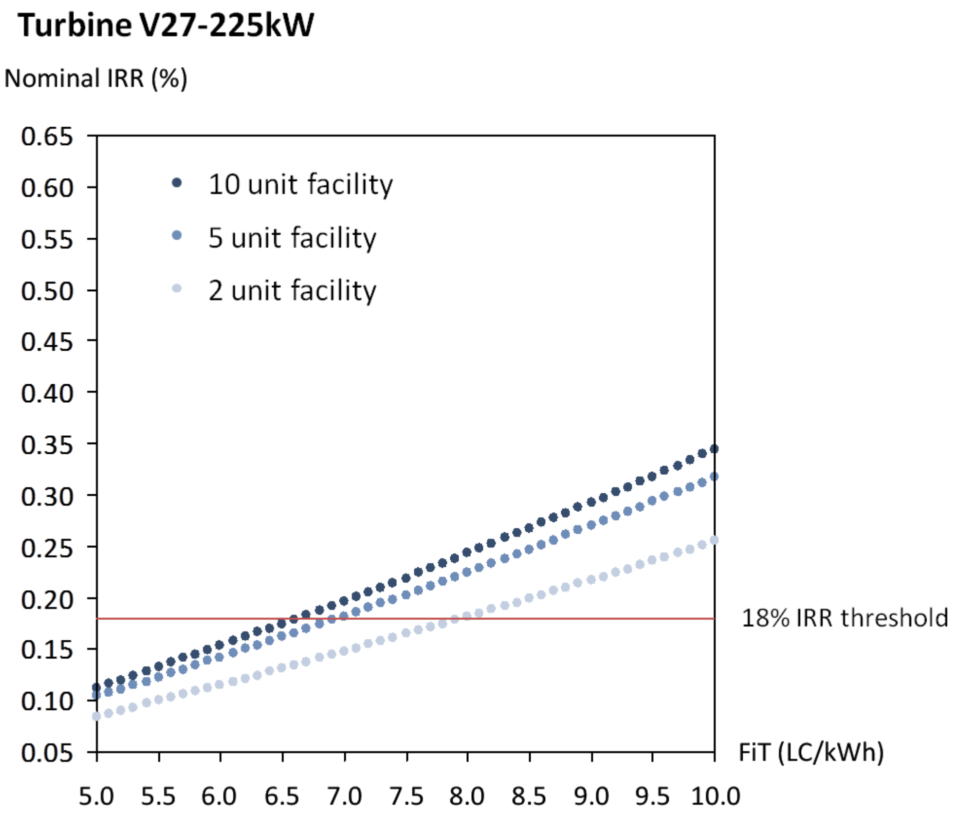
**Appendix 16** – Sensitivity analysis of WfP project IRR to number of V27-225kW units (capacity) and FIT (PHP/kWh)

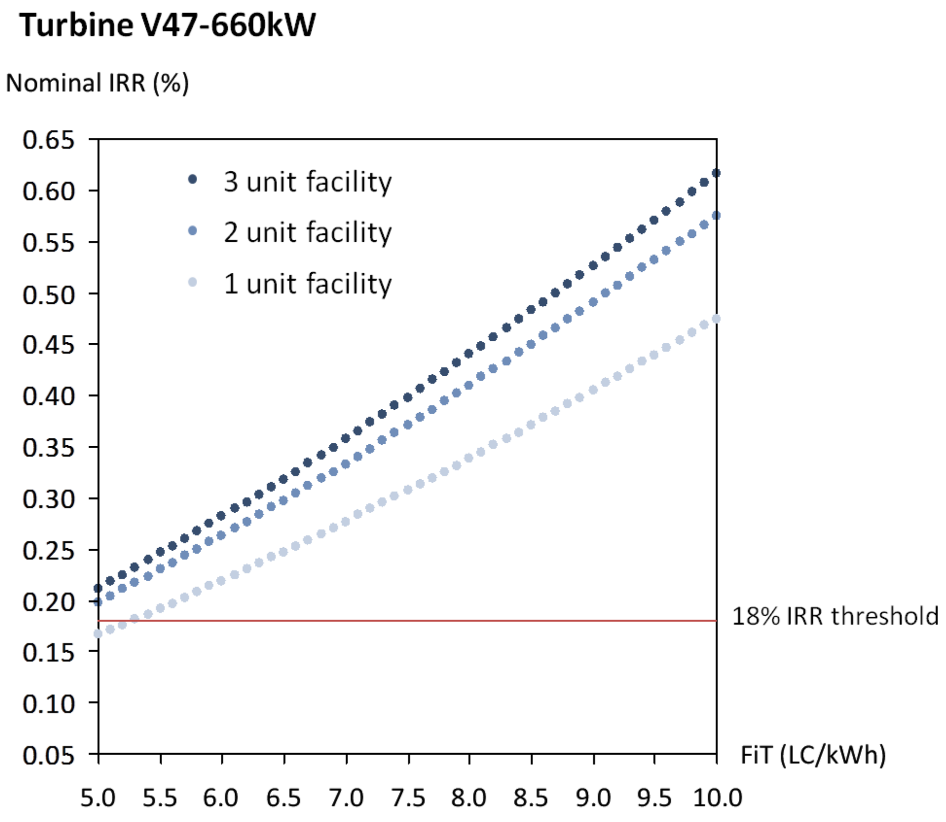
| *Capacity (MW)* | No. Units | FIT (LC/kWh) | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 5.00 | 5.25 | 5.50 | 5.75 | 6.00 | 6.25 | 6.50 | 6.75 | 7.00 | 7.25 | 7.50 | 7.75 | 8.00 | 8.25 | 8.50 | 8.75 | 9.00 | 9.25 | 9.50 | 9.75 |
| 0.225 | 1 | 5.4% | 6.2% | 7.0% | 7.7% | 8.4% | 9.1% | 9.7% | 10.4% | 11.0% | 11.6% | 12.2% | 12.9% | 13.5% | 14.1% | 14.8% | 15.5% | 16.2% | 16.8% | 17.5% | 18.2% |
| 0.45 | 2 | 8.4% | 9.2% | 10.0% | 10.7% | 11.5% | 12.3% | 13.1% | 13.9% | 14.8% | 15.6% | 16.5% | 17.3% | 18.1% | 19.0% | 19.9% | 20.8% | 21.7% | 22.6% | 23.6% | 24.5% |
| 0.675 | 3 | 9.5% | 10.3% | 11.1% | 12.0% | 12.9% | 13.8% | 14.7% | 15.6% | 16.5% | 17.4% | 18.4% | 19.3% | 20.3% | 21.3% | 22.3% | 23.3% | 24.4% | 25.4% | 26.5% | 27.6% |
| 0.9 | 4 | 10.0% | 10.9% | 11.8% | 12.7% | 13.7% | 14.7% | 15.6% | 16.6% | 17.5% | 18.5% | 19.5% | 20.6% | 21.6% | 22.6% | 23.7% | 24.8% | 26.0% | 27.1% | 28.2% | 29.3% |
| 1.125 | 5 | 10.4% | 11.3% | 12.2% | 13.2% | 14.2% | 15.2% | 16.2% | 17.2% | 18.2% | 19.2% | 20.3% | 21.3% | 22.4% | 23.5% | 24.7% | 25.8% | 27.0% | 28.2% | 29.3% | 30.5% |
| 1.35 | 6 | 10.7% | 11.6% | 12.6% | 13.6% | 14.6% | 15.6% | 16.6% | 17.6% | 18.6% | 19.7% | 20.8% | 21.9% | 23.0% | 24.2% | 25.4% | 26.5% | 27.7% | 28.9% | 30.1% | 31.3% |
| 1.575 | 7 | 10.8% | 11.8% | 12.8% | 13.8% | 14.9% | 15.9% | 16.9% | 17.9% | 19.0% | 20.1% | 21.2% | 22.3% | 23.5% | 24.7% | 25.8% | 27.0% | 28.2% | 29.5% | 30.7% | 31.9% |
| 1.8 | 8 | 11.0% | 12.0% | 13.0% | 14.0% | 15.1% | 16.1% | 17.1% | 18.2% | 19.3% | 20.4% | 21.5% | 22.6% | 23.8% | 25.0% | 26.2% | 27.4% | 28.7% | 29.9% | 31.1% | 32.4% |
| 2.025 | 9 | 11.1% | 12.1% | 13.1% | 14.2% | 15.2% | 16.3% | 17.3% | 18.4% | 19.5% | 20.6% | 21.7% | 22.9% | 24.1% | 25.3% | 26.5% | 27.8% | 29.0% | 30.2% | 31.5% | 32.8% |
| 2.25 | 10 | 11.2% | 12.2% | 13.2% | 14.3% | 15.4% | 16.4% | 17.5% | 18.5% | 19.7% | 20.8% | 21.9% | 23.1% | 24.3% | 25.5% | 26.8% | 28.0% | 29.3% | 30.5% | 31.8% | 33.1% |

**Appendix 17** – Sensitivity analysis of WfP project IRR to number of V47-660kW units (capacity) and FIT (PHP/kWh)

| *Capacity (MW)* | No. Units | FIT (LC/kWh) | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 5.00 | 5.25 | 5.50 | 5.75 | 6.00 | 6.25 | 6.50 | 6.75 | 7.00 | 7.25 | 7.50 | 7.75 | 8.00 | 8.25 | 8.50 | 8.75 | 9.00 | 9.25 | 9.50 | 9.75 |
| 0.66 | 1 | 16.6% | 17.9% | 19.2% | 20.5% | 21.9% | 23.3% | 24.7% | 26.2% | 27.7% | 29.2% | 30.7% | 32.2% | 33.8% | 35.4% | 37.1% | 38.8% | 40.5% | 42.2% | 43.9% | 45.7% |
| 1.32 | 2 | 19.8% | 21.4% | 23.0% | 24.6% | 26.3% | 28.0% | 29.7% | 31.5% | 33.3% | 35.1% | 37.1% | 39.0% | 41.0% | 42.9% | 44.9% | 47.0% | 49.0% | 51.1% | 53.2% | 55.3% |
| 1.98 | 3 | 21.2% | 22.8% | 24.6% | 26.4% | 28.2% | 30.0% | 31.8% | 33.7% | 35.7% | 37.7% | 39.8% | 41.8% | 43.9% | 46.1% | 48.2% | 50.4% | 52.6% | 54.8% | 57.1% | 59.3% |
| 2.64 | 4 | 21.9% | 23.7% | 25.5% | 27.3% | 29.2% | 31.0% | 32.9% | 35.0% | 37.0% | 39.1% | 41.3% | 43.4% | 45.6% | 47.8% | 50.0% | 52.3% | 54.5% | 56.8% | 59.1% | 61.5% |
| 3.3 | 5 | 22.3% | 24.2% | 26.0% | 27.9% | 29.8% | 31.7% | 33.7% | 35.8% | 37.9% | 40.0% | 42.2% | 44.4% | 46.6% | 48.9% | 51.1% | 53.4% | 55.8% | 58.1% | 60.5% | 62.8% |

**Appendix 18** – Graphical analysis of IRR sensitivity to FIT for multiple-sized facilities of V27 and V47 turbines



# References

[i] As of December 2013, according to Vestas' Track Record report 2013
[ii] Morales, A 2014, "Vestas Regains Wind Turbine Market Share Lead in Navigant Study", Bloomberg, < http://www.bloomberg.com/news/2014-03-26/vestas-regains-wind-turbine-market-share-lead-in-navigant-study.html>
[iii] Vestas FY2013 Presentation
[iv] Bert Nordberg, Chairman of the Board of Directors, in the AR2013
[v] Morales, A 2014, "Vestas Regains Wind Turbine Market Share Lead in Navigant Study", Bloomberg, < http://www.bloomberg.com/news/2014-03-26/vestas-regains-wind-turbine-market-share-lead-in-navigant-study.html>
[vi] According to the IEA, World Energy Outlook 2012, fossil fuels are receiving 6 times the level of subsidies of renewable energy
[vii] Estimates by the GWEC indicate capacity to surpass 80GW by 2020, up from 5.4GW in 2012
[viii] Various sources: DB Climate Change Advisors "Repowering America: Creating Jobs", 2011; Citi Global Perspectives & Solutions "Energy Darwism", 2013
[ix] 4% growth rate by IHS Emerging Energy Research (Dec 2013); 10% by MAKE Consulting (Nov 2013)
[x] Estradé, J 2011, "Wind energy: drivers, trends and the problem of large scale integration within electric grids", Our Energy Futures, <http://ourenergyfutures.org/page-titre-Wind_energy_drivers_trends_and_the_problem_of_large_scale_integration_within_electric_grids-cid-16.html>
[xi] V-27 (225kW) and V-47 (660kW) Vestas turbines
[xii] IEA Southeast Asia Energy Outlook 2013
[xiii] Ibid
[xiv] Bangui Bay Wind Power Project, in Ilocos Norte
[xv] Wholesale Electricity Spot Market
[xvi] "Awarded wind projects as of 31 January 2014", DOE
[xvii] 22nd Electric Power Industry Reform Act Implementation Status Report
[xviii] Energy Sector Accomplishment Report 2013, Department of Energy of the Philippines